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Kate graduated from the University of Bristol in 2006. Since graduating, she has travelled to over thirty countries and worked as a veterinary surgeon in Australia, New Zealand and the United Kingdom. She currently lives in East Anglia and works as a freelance small animal locum for her company, Lend a Paw Locums.

**Suggested Personal & Professional Development (PPD)*

BITE WOUNDS

Bite wounds

Bite wounds are common injuries in first opinion and referral practices. One-third of all traumatic emergencies presented to the Royal Veterinary College involved penetrating injuries and half of those were bite wounds (Halfacree, 2017).

Most bite wounds are laceration or puncture wounds with crushing components, and many patients have multiple wounds (Griffin, 2001). Perforating wounds may be associated with extensive tissue disruption and/or visceral damage (Risselada, 2017).

Bite wounds are more common in dogs than cats. Cats are less likely to engage in physical confrontation and are quicker to escape, though, if caught, they are more likely to be seriously injured. Dog-on-cat encounters often cause more damage than cat-on-cat and dog-on-dog fights (Halfacree, 2017), while the prognosis for cats with thoracic trauma is particularly grave.

Assessment and triage

Animal bite patients are often rushed in as emergencies and are often in a state of shock. Stabilise the airway and give oxygen if required. Assess circulation and administer fluids before giving pain relief and, if appropriate, antibiotics. Remember that impressive injuries may not be immediately life-threatening.

Initial assessment

Shaving is often required to reveal the full extent of wounds. There may be significant crushing injuries that are not immediately apparent. This is often indicated by bruises which may appear well after the trauma.

Minimal surface damage may hide severe traumatic wounds (Grambow Campbell, 2013), and apparently stable patients may re-present with sepsis or systemic inflammatory response syndrome (SIRS) days later (Grambow Campbell, 2013). This is called the iceberg effect. Photographs taken at the time of injury may aid subsequent wound assessment and may be required for any subsequent legal action by the client (Grambow Campbell, 2013). Assessment may be aided by a trauma triage scale such as the Penn State Animal Trauma Triage Scale. Wounds should be covered by sterile dressings following assessment.

Laboratory testing such as a CBC, chemistry panel and, ideally, urinalysis should be obtained at this time to monitor patient progress (Grambow Campbell, 2013).

Analgesia

Bite wounds can be extremely painful. This pain may not always be appreciated by examining the outside of the wound. A pure opioid agonist should be used. Response should be closely monitored, and further pain relief used as appropriate.

Non-steroidal anti-inflammatories reduce swelling and discomfort, and may be used once patients are clinically stable. However, in patients with hypoperfusion,

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Bite wounds may appear as relatively small punctures.

Bruising and other damage may be revealed by clipping.

Bite wounds may look impressive but remain relatively superficial.

Equipment for wound flushing.

A pressure cuff in use.

there is an increased risk of adverse effects such as renal injury (Halfacree, 2017).

Antibiotics

Bite wounds are often heavily contaminated. Infections are often polymicrobial with a broad mixture of anaerobic and aerobic bacteria. This often reflects the oral flora of the biting animal, the victim's own skin or the environment at the time of injury (Abrahamian, 2011).

Bacterial strains involved in dog bites include the aerobes *Pasteurella, Streptococcus* and *Staphylococcus*; and anaerobes *Fusobacterium* and *Bacteroides* (Abrahamian, 2011), as well as a host of less frequently found organisms. Cat bite wounds are also polymicrobial, with a high risk of infection with *Pasteurella* species being the most common.

Owing to this risk of polymicrobial infection, antibiotics are often administered at the time of injury. However, it is possible for bite wounds to yield no growth on bacterial culture, with between half (Ateca, 2014) one-third (Griffin, 2001) and 16 per cent (Meyers, 2008) of cultured wounds yielding negative cultures, depending on the study. However, it is important to remember that in vitro results may not always reflect the behaviour of wounds in vivo.

The main cause of post-operative mortality in trauma patients with animal bite wounds is sepsis, SIRS, and subsequent multiple organ failure. Antibiotics should not be withheld in severe cases.

Wounds should be sampled for culture and sensitivity prior to antibiotic treatment. A sample of deep tissue may yield more representative results than a skin swab (Grambow Campbell, 2013).

Empirical treatment with a broad-spectrum antibiotic such as potentiated amoxicillin-clavulanate may be instituted as appropriate – pending results. Higher tier antibiotics, such as fluoroquinolones, should only be used if culture and sensitivity results indicate.

If owner finances are limited, it is vital to lavage and explore the wound before giving empirical antibiotics. A sample may be taken but submitted only if there are clinical concerns. However, plating delay may decrease likelihood of a representative culture (Halfacree, 2017).

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Post-operative antibiotics may not be required for immunocompetent patients with fresh, shallow, non-crushed and uninfected wounds where only healthy tissue remains after debridement and lavage (Grambow Campbell, 2013).

In addition, bite wounds involving the limbs may lead to fractures, which may be stabilised initially and treated as appropriate. Joint taps are recommended in bite wounds involving the joints, owing to the high risk of joint infection.

Viruses

Cats bitten by other cats should ideally be tested for FIV and FeLV 60 days plus after the bite (Grambow Campbell, 2013). In foreign countries, the risk of transmission of viruses such as rabies must be considered while dealing with animal bite wound cases (Abrahamian, 2011).

Surgery

Bite wound patients with penetrating thoracic, head, neck or abdominal wounds should be imaged once stable. Radiography or ultrasonography may help veterinary surgeons decide whether surgical exploration is indicated, but imaging will not always indicate if penetrating injury has occurred. Even if there are no radiographic signs such as free abdominal gas or pneumothorax, it is easy to miss a deep penetration.

It is recommended to anaesthetise or sedate the patient – once stable – in order to thoroughly explore the wounds (Halfacree, 2017).

In cases of thoracic bite wounds, the severity of abnormalities seen on imaging correlates directly with the decision to perform exploratory thoracotomy (Halfacree, 2017). A visible penetrating injury, more than three bite wounds, or several bite wounds close together increases the risk of a thoracotomy being required.

Delayed closure may not always be possible.

The same wound following clipping.

The wound post-closure.

Hasty surgical closure may lead to wound breakdown.

The same wound one week later.

This wound healed well by secondary intention.

Although hospitalisation time may be longer in patients requiring a thoracotomy, mortality has not been found to increase (Cabon, 2015).

Timing

Patients should be stabilised prior to anaesthesia. However, some injuries must be addressed immediately – for example, a protruding lung lobe or sucking chest wound that cannot be managed with a dressing.

Increased time to anaesthesia has been associated with a longer recovery (Ateca, 2014), and surgical patients should be ideally addressed within four to six hours of presentation; also known as the so-called 'golden hour'. However, a 12- to 24-hour delay in surgery may allow patient stabilisation and for tissues to declare as viable or non-viable when fresh wounds are concerned in stable patients (Grambow Campbell, 2013).

Debridement

Antibiotics do not replace thorough debridement and lavage. Once anaesthetised or sedated, thorough wound lavage should be performed using sterile sodium lactate or 0.9 per cent sodium chloride under pressure. The flushing pressure required to dislodge bacteria exceeds seven pounds per square inch, which is effectively achieved using a one litre plastic bag and cuff pressurised to 300mm Hg (Gall, 2010). Alternatively, a 25ml syringe and 21g (green) needle attached to a three-way-tap and giving set may be used (Halfacree, 2017).

Non-viable tissue should be removed. Bruised tissue of uncertain viability may be retained *in situ* and reassessed in 36-48 hours if the circumstances permit. Any septic focus may lead to wound infection and increase the risk of sepsis, so if the tissue is not essential, it is appropriate to debride more tissue than less. Staged evaluation should be carried out every 24-48hrs with debridement as required (Halfacree, 2017).

Wet-to-dry dressings are important debridement tools. These are open weave sterile gauze swabs soaked in saline before being wrung out and applied directly to the wound bed. The swab dries onto tissue and is removed without being soaked away. Non-viable tissue is removed attached to the swab; leaving a viable bleeding surface. Dry swabs may be applied directly onto exudative wounds. This dressing should be covered with more dry swabs and a bandage, and re-evaluated in 24 hours. This debridement – while undoubtedly effective – can be painful and requires daily sedation or general anaesthesia (Halfacree, 2017).

It is important to ensure that patients requiring sedation or anaesthesia for repeated dressing changes receive adequate nutrition between fasted periods to provide adequate proteins and albumin for healing (Halfacree, 2017).

Drainage

If any significant questionable tissue remains following debridement, surgical closure should ideally be delayed post-dressing. However, this may not always be possible owing to surgical or financial limitations.

Tissue fluid may accumulate beneath the wound and may lead to infection if left. Surgical drains may be used to reduce fluid build-up (Halfacree, 2017).

Penrose or active suction drains may be used in wound care. There are advantages and disadvantages to each. Active suction drains are a closed system, with less risk of ascending infection than passive systems such as Penrose drains. However, active drains can block and may lose suction. If the wound is already contaminated and drainage from the site is optimal, a passive system such as a Penrose drain may be more effective (Halfacree, 2017).

Factors influencing outcome

- deep muscle injury: increased mortality is seen in patients with deep muscle injury when compared to patients with superficial bite wounds involving skin only. If deep muscle structures are involved, mortality increases to approximately 20 per cent. However, if wounds extend to the thoracic cavity, no increase in mortality is seen (Halfacree, 2017)
- prolonged anaesthesia time (Ateca, 2014)
- presence of SIRS: there is a 24 per cent increase in mortality rate in dogs developing SIRS (Ateca, 2014)
- multiple organ dysfunction: in a referral situation, a nine per cent mortality rate was seen in dogs with dysfunction of one organ system, and a 67 per cent mortality rate was seen in patients with dysfunction of more than four organs (Ateca, 2014)
- increased trauma score is associated with decreased outcomes. Every point increase on an animal trauma triage scale corresponds approximately to two times decrease in the likelihood of survival (Rockar, 1994).

Conclusion

It is vital to stabilise the patient, if possible, before attempting surgical repair. Opioid analgesic is effective and safe in trauma patients, while non-steroidal anti-inflammatories may be used in patients with optimal hydration to reduce swelling and inflammation. Wounds should be sampled if possible, and empirical treatment with

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a broad-spectrum antibiotic instituted pending culture and sensitivity results.

Diagnostic imaging is helpful in decision-making, but doesn't always give you good information; so wounds ideally should be explored within four to six hours of presentation. Lavage with a pressure exceeding seven psi is recommended to dislodge bacteria.

Should wounds prove fatal, post-mortem by a certified pathologist is recommended in case the client proceeds with legal action against the attacker's owner. ■

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PPD Questions

1. An acute animal bite case is rushed in. What is the first thing you should do?

   A. give pain relief
   B. clip and lavage wounds
   C. check and stabilise airway
   D. administer IV fluids.

2. What percentage mortality is seen in animal bite cases with dysfunction of more than four organs in a referral situation?

   A. 67 per cent
   B. 25 per cent
   C. 9 per cent
   D. 80 per cent.

3. Which kind of dressings should be used to debride a patient with very moist, exudative bite wounds?

   A. wet to dry
   B. dry to wet.

4. Bacterial strains cultured from dog and cat bite wounds include:

   A. *Staphylococcus*
   B. *Streptococcus*
   C. *Pasteurella*
   D. *Bacteroides*
   E. all of them.

5. An increase of one point in the animal trauma triage scoring system leads to approximately how many times decrease in survival?

   A. one
   B. two
   C. ten
   D. five.

Answers
1.C 2.A 3.B 4.E 5.B

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